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REPORT OF CHIEF OF BUREAU OF BIOLOGICAL SURVEY

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., August 20, 1926.

SIR: I have the honor to submit herewith a report of the operations of the Bureau of Biological Survey for the fiscal year ended June 30, 1926.

Respectfully,

E. W. NELSON,
Chief of Bureau.

Hon. W. M. JARDINE,
Secretary of Agriculture.

ORGANIZATION AND FUNCTIONS

Organized as a separate branch of the Department of Agriculture 40 years ago (July 1, 1886), the Bureau of Biological Survey, then designated the Division of Economic Ornithology and Mammalogy, has developed steadily in usefulness as new duties have been added and now may be said to function along all lines having to do with the conservation, utilization, and control of wild life. Wild life, as here used, embraces the birds, mammals, reptiles, and amphibians—all the vertebrates except fishes. The study of their habits, distribution, and economic relationships involves a wide range of investigation. The conservation of the valuable and harmless and the control of the injurious species present many difficult problems, which involve the interests of the people of the entire country to a much greater extent than is commonly understood. The functions of the bureau are performed through seven divisions, as follows:

Economic Investigations, A. K. Fisher, in charge. Studies are made of the economic relations of wild mammals and of effective methods of controlling their depredations in areas devoted to agriculture, stockraising, horticulture, and forestry, and leadership is furnished in cooperative campaigns for the extermination of predatory animals, destructive rodents, and other injurious species.

Fur Resources, Frank G. Ashbrook, in charge. Experiments are conducted in the production of fur-bearing animals in captivity and under wild and semiwild conditions, including rabbits for meat and fur, and measures are investigated for the prevention and cure of parasitic and other diseases of animals on fur farms and for the utilization of fur as a natural resource.

Food Habits Research, W. L. McAtee, in charge. This division investigates the economic status of birds, reptiles, and amphibians through field and laboratory studies of their food habits, with a view to making recommendations for the control of the harmful and the conservation of the useful species; and studies the food resources of water areas suitable for migratory wild fowl and methods of increasing game and other useful birds.

Biological Investigations, H. H. T. Jackson, in charge. Field and laboratory investigations are made of the classification, distribution, migration, and other habits of native wild birds, mammals, and plants, biological surveys are conducted over major areas, and maps are made of natural life zones to provide the fundamental scientific information necessary for

use in the economic, regulatory, and other activities of the bureau.

Alaskan Wild Life, the chief of bureau and W. F. Bancroft, in charge. Investigations are conducted for the improvement of reindeer in Alaska, and for developing sheep grazing and fur farming within the Aleutian Islands Reservation; field studies are made of the habits and distribution of the valuable wild life; and through representation on the Alaska Game Commission assistance is given in the protection and upbuilding of the fur, game, and other wild-life resources of the Territory.

Game and Bird Reservations, E. A. Goldman, in charge. The establishment of wild-life refuges is promoted, and 72 Federal reservations for big game and birds are maintained, including the Elk Refuge in Wyoming, where hay is produced for winter feeding; and the problem of utilizing the increase of game on reservations is studied with a view to restocking other areas or selling or otherwise disposing of the surplus.

Protection of Migratory Birds, Talbott Denmead, acting in charge. Federal laws are administered protecting migratory game and other birds, governing interstate commerce in game, and regulating importations of foreign wild birds and mammals. Early in the fiscal year George A. Lawyer resigned as chief United States game warden in charge of this division and H. P. Sheldon was appointed to succeed him, reporting for duty on July 14, 1926.

ECONOMIC INVESTIGATIONS OF WILD ANIMALS

Wild animals in the United States have taken full advantage of the increase of crop and livestock production and from the first settlements have exacted tribute from agriculture amounting during a long period to many millions of dollars annually. Extended investigations have been necessary to determine the character and extent of their destructiveness, the animals responsible, the relation that these animals may sustain to agricultural interests, and methods of combating them. Prevalence among wild animals of diseases communicable to man or domestic animals likewise has required the employment of control measures. Wherever repressive measures have been necessary, effective and economical methods and plans of organization have been devised to meet various situations in a practical way. Constant study is made to develop more effective and economical methods and the present year has shown excellent results in this direction.

To accomplish adequate control at a minimum cost the Biological Survey has enlisted the cooperation of Federal, State, and local agencies on an extended scale and has provided trained and experienced leadership in coordinating field work. Research and field operations vigorously prosecuted during the year have shown a high degree of effectiveness and have made a material reduction in losses from animal pests.

Approximately $462,240 in Federal funds were available for investigational work and for field operations on the public domain and for cooperative work elsewhere. Of this sum $21,340 was used in investigational work, $274,220 in the destruction of predatory animals, and $166,680 in the control of rodents and other small animal pests. Organized field work was conducted in 17 States, which provided by appropriation and otherwise cooperative funds of approximately $989,620, an increase of about $150,000 over similar funds available during the previous year. Of these cooperative funds approximately $375,060 was expended for the destruction of predatory animals and $614,560 in rodent-control work.

At the time the Biological Survey began its control of predatory animals the annual losses from these destructive pests to the livestock growers of the West were estimated to lie between $20,000,000 and $30,000,000. As a result of the work of the bureau and its cooperators gray wolves have been nearly eliminated from the ranges, and hundreds of thousands of coyotes and other predatory species have been destroyed. This has resulted in a permanent lessening by more than half of the former losses from this source, in addition to the saving made by the animals killed each year. Counting the permanent results, the annual savings to the livestock growers from the predatory-animal campaign may be conservatively estimated as between $12,000,000 and $15,000,000.

At the time the Survey began its work on a large scale for the control of the wild rodent pests the annual losses were estimated to approximate $300,000,000. The work of the bureau and its cooperators has resulted in

enormously decreasing the number of rodents over a vast territory, approximating 138,000,000 acres. It is difficult to estimate the amount of the gross savings in this instance, but there is little question that the increased annual crop and forage production runs into tens of millions of dollars in value.

PREDATORY ANIMALS

Operations for the control of wild-animal destroyers of livestock and game have been conducted in 14 States—Arizona, California, Colorado, Idaho, Illinois, Montana, Nevada, New Mexico, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. During the year the skins and scalps of 202 wolves, 35,619 coyotes, 3,149 bobcats, 55 Canada lynxes, 167 mountain lions, and 176 stock-killing bears were turned in as evidence of kills by hunters working under the bureau's supervision, and in addition it is estimated that approximately 70,000 coyotes were killed, the skins and scalps of which were not recovered because of the impractibility of locating all the carcasses after poisoning operations. On the generally accepted basis of computing losses inflicted by predatory animals, this year's operations represent a saving of livestock and game valued at more than $5,000,000.

The year's work has been conducted in cooperation with State departments of agriculture, State livestock commissions, game commissions, agricultural extension services, and stockmen's associations, and with individuals, and effort was made to utilize every possible assistance that might be rendered by other Federal, State, or local agencies. Special emphasis has been placed on helping stockmen to help themselves. To this end demonstrations have been given on the stock ranges of effective methods employed in trapping and poisoning, and aid has been rendered stockmen in obtaining at reduced cost the poison needed for this work. Persistent poisoning, trapping, and den hunting have struck predatory animals a heavy blow, and sweeping headway is being made in bringing them under control and greatly reducing the losses from this source.

WOLVES

The large gray, or lobo, wolves have been so reduced that their depredations are almost ended. Highly skilled men trap or kill with poison the few scattered individuals promptly after their presence on the range is reported by interested stockmen. As against 31 wolves taken in New Mexico last year only 8 were taken this year, despite increased efforts to get the last one in the State. Arizona, with 18 taken during the year, reports no wolves now known to be within its borders. It is necessary, however, to maintain a constant patrol along the New Mexico and Arizona boundary to prevent invasions of timber wolves and mountain lions from Mexico. For the first year in the history of the work not a single lobo wolf was taken in Colorado and less than half a dozen are known to range within the State. The catch in Montana was 28; in Oregon, 1; South Dakota, 6; Utah, 8; and in Wyoming, 12.

COYOTES

Extended poisoning campaigns, with strychnine specially prepared by the bureau for the purpose, have proved the most effective weapon for killing the bulk of the coyotes destroyed. The campaigns are organized in close consultation with stockmen and cover in a methodical way the important summer and winter ranges so far as funds permit and cooperation can be enlisted.

The hearty cooperation of stockmen has been an outstanding feature of the work. They have contributed funds, animals for poison stations, and personal services. As a result the losses due to the depredations of coyotes have been materially lessened. Following intensive poisoning and trapping operations around lambing grounds many stockmen report that their herds passed through the lambing season without a single loss or even hearing a coyote howl, and many sheep owners report that they have been able to reduce their labor costs more than half.

Typical of results from well-placed poison stations, one hunter in Colorado picked up 24 coyote carcasses about a single station at a natural crossing place, and no doubt more were killed than were actually found, because the surroundings were rough range lands with considerable brush.

Coyotes occur over such an enormous territory that they still continue to breed in places that it has not been possible to reach, and drift out from such points to restock areas that have been cleared, thus making it necessary to wage a continuous fight to afford protection on the livestock

ranges. They have increased in Illinois during the year and even invaded western New York.

In many localities reducing the numbers of coyotes has been followed by a marked increase in such game birds as grouse, quail, ptarmigan, sage hens, and wild turkeys, and in the number of young raised by deer and antelope.

MOUNTAIN LIONS

The 167 mountain lions destroyed during the year were distributed as follows: Arizona, 88; California, 6; Colorado, 6; Montana, 4; Nevada, 1; New Mexico, 44; Oregon, 7; Utah, 7; Washington, 4. Effort has been concentrated chiefly upon individual mountain lions that were reported on livestock ranges or, in cooperation with the State game departments, on animals that were destroying deer and other important animals on game ranges.

BOBCATS AND LYNXES

Considerable numbers of bobcats and lynxes occur in rough areas on stock ranges, and wherever they prove seriously destructive to livestock interests they can be brought under control with reasonable promptness by trapping and hunting with dogs. Many of these animals as well as coyotes are killed by private trappers for their fur.

BEARS

Generally bears are looked upon as relatively harmless animals and in many States are considered game. Individual bears sometimes become livestock killers, however, even when natural food is apparently abundant. Hunters of the Biological Survey are strictly instructed to kill only such bears as are known to be preying upon livestock, or in cooperation with State game departments, animals that are unduly destructive to other game. Limited in accordance with these instructions the kill of bears for the year totaled only 176 in the entire West.

RABIES CONTROL

The most serious of the sporadic cases of rabies among predatory animals in the Western States occurred this year in Washington and Colorado. Reduction in the number of coyotes has been a material factor in preventing outbreaks of this disease and helping suppress it when an outbreak occurs. The field organization of the bureau is constantly alert, and as the result of experience, hunters are quickly concentrated to handle rabies outbreaks and promptly control and suppress them in cooperation with State and local health and sanitary officials. The saving to stock growers from rabies control alone is great.

FOOT-AND-MOUTH DISEASE AMONG DEER

It is a matter of gratification to report that the foot-and-mouth disease among deer in California, which was recounted in the previous report, has been completely suppressed. Good progress in the eradication of this dangerous disease had been made by the close of the previous fiscal year, but much work has been required during the current year to insure its complete eradication. Careful study was made to locate the various possible sources of infection, in order that these danger points might be effectively guarded and the disease prevented from spreading through the seasonal movements of the deer. In cooperation with the Bureau of Animal Industry and the California State Department of Agriculture, a strong force of hunters and veterinarians was maintained for this work, which also had the support of the State board of fish and game commissioners.

Hunters' camps also were located at each mountain pass in the Sierra Nevada to the south and east of the summer range where the disease had existed, and it is believed that not a deer passed through these defense lines during the summer, possibly to carry infection into new territory. At the beginning of the fall migration of deer into the lower country careful check showed no new infection or signs of old. The number of men employed was thereupon materially reduced, but careful observation was maintained to insure that no infected animals should be left at large. After the deer were established on the winter ranges they were watched carefully and an occasional one that showed some abnormality was killed for examination.

This went on until May, 1926, when officials of the Bureau of Animal Industry pronounced the disease entirely eradicated. The Biological Survey at once discontinued its activities along this line. As explained in the previous report this work was of an emergency character, and was undertaken by the bureau only upon urgent appeal by other Federal and State

agencies. Great credit is due the leaders and the experienced force of hunters that had been employed in predatory-animal and rabies-control work in California, who, through their knowledge, skill, and efficient service, made it possible absolutely to limit the spread of this dread livestock disease and to suppress it completely among deer, thus ending a serious menace to the livestock industry.

INJURIOUS RODENTS

POISON TESTS

The investigational program to develop new poisons for use in combating the various rodents that destroy farm crops, forage grasses, orchards, vineyards, and nurseries has been continued vigorously, the main objectives being increased effectiveness over present known methods and reduced cost of control operations.

Especially gratifying progress has been made in adapting various thallium derivatives for use in meeting specialized local conditions where other poisons and fumigants have not proved satisfactory. Developments of the year constitute important contributions to control methods for certain ground squirrels, prairie dogs, and house rats, and the discoveries will doubtless prove applicable to many other destructive rodents. The extreme deadliness of thallium products has led the bureau to proceed with caution in applying it under field conditions, in order to maintain safeguards against injury to valuable species as well as to persons engaged in the work.

Studies to determine manufacturing processes that will insure the maximum toxicity of red-squill products were conducted in collaboration with the office of drug and other plants, of the Bureau of Plant Industry, and with the pharmacological laboratory, of the Bureau of Chemistry. In field and laboratory tests with squill for the destruction of house rats, a stable and efficient poison has been developed to meet special requirements in the control of these widely distributed and highly destructive pests.

Important progress has also been made in adapting crude calcium cyanide for use against various species of rodents where fumigation methods are applicable.

COOPERATION

Effort has been made at all times to articulate the work efficiently with all other Federal, State, and local agencies with a view to avoiding duplication of effort and insuring the largest possible returns in service for funds expended. The bureau has continued its cooperation with the Office of Cooperative Extension Work, the extension-service organizations of agricultural colleges, including county agricultural agents, and with State departments of agriculture, county commissioners, and various agricultural, horticultural, and livestock organizations. In work on Federal lands it has had the cooperation of the Forest Service and the Bureau of Animal Industry, of this department, and the Office of Indian Affairs and the Reclamation Service, of the Department of the Interior.

PRAIRIE DOGS AND GROUND SQUIRRELS

The work of reclaiming grazing lands and reducing losses of farm crops from the destructive activities of prairie dogs and ground squirrels has proved of such evident and direct value in the past that demand for it has greatly increased. Reports of stockmen and farmers show marked increase in carrying capacity for livestock on pastures and materially greater yields of forage and grain crops as a result of eliminating these rodents. First treatment with poisoned-grain baits was given to 10,571,296 acres of Federal, State, and private lands, and follow-up work to destroy most of the survivors on 4,486,674 acres. This brings the total acreage treated for control of these animals to 13,457,197 on Federal, and 124,880,786 on State and private lands. Stockmen and farmers have paid the cost of work on their own holdings and in addition have contributed many thousands of dollars worth of labor in distributing poison on adjacent Federal and State lands. Revolving funds have been continued by State officials and county commissioners to purchase and prepare poison supplies in wholesale quantities, and this has resulted in material saving in the cost of operation. The saving in crop and range grasses resulting from work during the year is estimated at more than $6,800,000, without counting the permanent improvements from the work of previous years. A total of 1,218 tons of poison grain has been used in these cooperative poisoning campaigns. In addition 384,132 pounds of carbon disulphide and 184,041 pounds of crude calcium cyanide have been used as fumigants in follow-up opera-

tions to complete eradication of prairie dogs and ground squirrels not killed by poison.

POCKET GOPHERS

In response to increasing demands for assistance in controlling pocket gophers, demonstrations have been given and control operations carried on in Arizona, California, Colorado, Idaho, Kansas, Montana, Nevada, New Mexico, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. These pests were largely eliminated from 285,834 acres.

JACK RABBITS AND COTTONTAILS

Cooperative control of jack rabbits was continued in localities where these rodents had increased to destructive numbers or had migrated from open range lands to attack cultivated crops. In Arizona, 8,000 acres were treated with 2,000 pounds of poison, resulting in a kill estimated at 100,000 rabbits. In Idaho, early in the summer of 1926, when the rabbits were migrating in hordes from desert range lands into irrigated valleys, 50,620 pounds of poison were used on 369,150 acres, with excellent results. In seven counties in Texas, 423 farmers with 23,600 pounds of poisoned bait killed more than 50,000 rabbits, effecting a saving estimated at about $44,000, at a cost of $1,775.50. Important progress was made in investigations to improve washes for tree trunks to lessen the damage by cottontail rabbits to orchard trees.

Warnings were issued during the year in various forms against the danger from tularemia to persons engaged in handling and dressing jack rabbits, snowshoe rabbits, and cottontails. Cooperative work with the United States Public Health Service was begun to determine the possible relationship of this disease to the abundance of game and other forms of wild life.

WOODCHUCKS

The increasing abundance and destructiveness of woodchucks in many parts of the country have called for demonstrations of effective methods of control. In one county in Illinois it is estimated that 90 per cent of the woodchucks have been destroyed by use of crude calcium cyanide. In Indiana and Illinois use of 50,000 pounds of this material in accordance with methods demonstrated by the Biological Survey resulted in a saving to farmers estimated at $250,000.

FIELD MICE

In California, Idaho, Oregon, Texas, Utah, Washington, and in many of the orchard sections of the Eastern States, an increase of field mice to destructive numbers has been reported locally. Widespread demonstration of control methods by field representatives of the bureau have led great numbers of orchardists to adopt field-mouse control as a regular feature of their orchard practice, and many now employ the special poison stations recommended by the bureau. In four counties of Idaho 6,900 pounds of poisoned bait were used. In the vicinity of one town in Indiana where demonstrations have been made within the past two years, at least 30,000 poison stations are now in use.

HOUSE RATS AND MICE

The bureau has continued investigations to determine methods adapted to meet the great variety of conditions under which house rats and mice must be combated in order to lessen the enormous losses to property and the serious danger to health involved in their presence. A number of special surveys have been conducted to note the conditions of rat infestation about warehouses, packing plants, and other places where damage to agricultural products occurred. Demonstrations were conducted and information given regarding control measures.

Results of surveys in agricultural and poultry-raising sections disclose that the numbers of rats are constantly augmented by their being carried in shipments of dairy and poultry feed from towns to farms. This emphasizes the nation-wide need for concerted effort between the rural and urban people as a basis for efficient control. The problem calls for widespread coordination of effort and the utmost persistence in the application of repressive measures. United action by representatives of farmers' organizations and chambers of commerce or other civic organizations has been encouraged, and practically all parts of the United States where rats occur have been reached by the educational work of the bureau.

PORCUPINES

Porcupines are apparently increasing in many sections, and because of the serious damage they do to forest trees and seedlings, and in some localities to corn, alfafa, and fruits, including raspberries, apples, cherries, and

prunes, investigations have been continued to determine effective methods for their control.

DIVISION OF FUR RESOURCES

The educational work of the bureau to develop a fuller realization of the importance of conserving fur as a valuable resource is being favorably received by conservation commissioners and societies and the National Association of the Fur Industry. Bureau representatives have attended meetings of conservationists, fur traders, and fur farmers and upon request have given information and suggestions and enlisted cooperation in protecting the sources of the fur supply. The annual summary of the fur laws, published in part to this end, was issued during the year as Farmers' Bulletin No. 1469.

FUR FARMING

A nation-wide study has been made of the factors influencing the production and the quality of fur from animals raised in captivity. Farms have been inspected where fur-bearing animals, including rabbits, are being raised, to obtain information on all phases of problems confronting fur farmers. Investigations of contagious diseases and parasitic infestation have made it possible for the bureau to advise farmers how to combat similar outbreaks and to improve the conduct of their operations. Fur farming has constantly developed until there are now about 2,500 fur farmers in the United States and Alaska, and about 1,500 in Canada, the majority of whom are raising silver or blue foxes. The total investment in the business is about $30,000,000 in the United States and Alaska and about $11,000,000 in Canada. The industry is not confined to the North American Continent, however, but has spread to European countries, where it has had a steady but quiet growth, and also to Japan.

In spite of a recent decrease in the prices paid for blue-fox skins, which has caused a number of farmers in Alaska to abandon their operations, blue-fox farming continues to flourish. A publication entitled "Blue-Fox Farming in Alaska," Department Bulletin No. 1350, issued in October, has greatly assisted blue-fox farmers and will be useful to those who contemplate engaging in the industry.

EXPERIMENTAL FUR FARM

The experimental fur farm at Saratoga Springs, N. Y., has been further developed with laboratory and farm equipment to facilitate research in growing animals for fur. Scientific studies and practical tests in breeding and feeding have been conducted with red, cross, and silver foxes and martens, and the percentage of fox pups raised was higher this year than in any previous season. Lack of breeding stock of the most desirable quality, however, has made impracticable the close culling needed fully to increase vitality, prolificness, and fur quality. Experiments to determine whether the undesirable characters of a samson fox (one lacking guard hairs and thus having a nearly worthless pelt) are transmitted in crossbreeding with foxes of superior quality have progressed sufficiently to justify advice against retaining any samson foxes as breeding animals.

To determine the effect of various rations on the health of captive animals and the quality of the fur produced, studies have been continued and observations made during the mating, gestation, and whelping periods. Several years must elapse, however, before sufficient data can be accumulated to permit final analyses and recommendations. Improved methods of handling diseased animals during treatment have been devised, and studies regarding the tolerance of foxes to various drugs have been continued. A report has been prepared for publication on critical tests of tetrachlorethylene as an anthelmintic for foxes.

Many visitors from all parts of the United States and Canada have inspected the experimental fur farm since it was established at Saratoga Springs, and it is planned to issue a leaflet describing the operation and purposes of the farm for visitors and for use in correspondence, to make more generally known the work that the department is doing to assist fur farmers.

RABBIT INVESTIGATIONS

For many years the bureau has been called upon to supply information on raising utility rabbits, and interest in the subject has developed so rapidly of late that an assistant has been appointed to devote the major part of his time to rabbit investigations. Many of the leading rabbitries on the west coast were inspected during the past year to note the possibilities in the sale of meat and fur and the best methods of breeding, feeding, and handling rabbits. Visits also were made to raw-fur houses and dressing and

dyeing plants for the purpose of studying their methods of sorting and grading rabbit skins as well as of dressing and dyeing. Cooperation between the bureau and rabbit breeders throughout the country, with a view to assisting breeders in selling pelts and obtaining the same average price for small as for large shipments, has resulted in the organization of the Rabbit Breeders Exchange, with headquarters in New York City.

It is planned to develop a rabbitry on the experimental fur farm, as rapidly as funds permit, with 100 breeding does, representing utility breeds, for the purpose of studying methods of feeding, breeding, and handling rabbits for the production of the best quality of meat and fur. A bulletin prepared during the year, entitled "Rabbit Skins for Fur," will be helpful to rabbit breeders and those planning to take up the work because of the improved methods detailed of skinning rabbits and preparing pelts for market. A mimeographed leaflet on chinchilla rabbits and lists of names and addresses of rabbit breeders also have been prepared for free distribution.

COOPERATIVE WORK

Under a cooperative agreement with the National Association of the Fur Industry part of the work accomplished on the distribution and protection of fur-bearing animals will be published with maps and photographs in the official organ of that association. The preliminary work in assembling data regarding the annual catch of fur animals has demonstrated the need of considerable improvement in obtaining statistics. Without accurate data kept by each State on the number of skins taken, it will be impossible to estimate the number of fur bearers trapped annually in the United States. Their total value is very great, and the cooperation of the bureau with other agencies should result in a marked increase in fur production.

In cooperation with the Bureau of Public Roads a practical type of fox den and pen has been designed, and more than 1,000 copies of blue prints of it have been mailed to inquirers.

DIVISION OF FOOD HABITS RESEARCH

ECONOMIC ORNITHOLOGY

The major work of this division is connected with problems of current importance in economic ornithology, in the solution of which both laboratory research and field surveys are employed.

BLACKBIRDS

The study of the relation of blackbirds to the rice crop of the Gulf coast, begun during the preceding fiscal year through a cooperative arrangement between rice growers of Louisiana and the Biological Survey, was continued and field work completed. During the summer of 1925 the fact was established that a material reduction in the number of blackbirds in the area is impossible during the growing and harvest seasons. The series of experiments carried out in the spring of 1926 to learn whether control by poisoning would be effective during the early part of the planting season, a period of comparative food scarcity, were by no means consistent although more satisfactory than those of the late spring of 1925. The area in which blackbird damage is severe enough to warrant the necessarily great expense of control is confined largely to a very narrow zone of coastal plain along the southern border of the rice area. To reduce creatures as nomadic as blackbirds in such a limited area would require operations in the whole region, over much of which blackbirds are not destructive enough to require drastic control, and in some situations they may even be beneficial to the farmer. The conclusions reached were that poisoning operations should be limited to the narrow zone of severe damage; that the use of poisoned baits at sprouting time has a certain deterrent effect on the birds; and that nothing but the use of firearms can curtail losses during the ripening period and harvest.

A manuscript was completed during the year on local control of birds, with special reference to crop protection.

BOBOLINKS

The relation of bobolinks to rice in the limited acreage still devoted to that crop in the South Atlantic States was the subject of an investigation during August, 1925. It was found that the damage may be as great as 30 per cent of the stand.

FISH-EATING BIRDS

Investigations of the food habits of cormorants and other fish-eating birds in Minnesota and North Dakota, begun in the previous fiscal year, were completed. The stomachs collected

have been examined and determination made that no serious damage to food and game fishes can be charged against cormorants in Minnesota, except at Lake of the Woods, where a concentration of the birds warrants local control measures. No damage requiring extensive control was discovered in the case of any other fish-eating bird in Minnesota or North Dakota. Stomachs examined included those of the great blue heron, the American bittern, four species of gulls, four of terns, the kingfisher, four species of grebes, and the loon.

INCREASING BIRD ENEMIES OF INSECT PESTS

An attempt to increase the number of birds as a method of controlling nut weevils has been started in cooperation with the Bureau of Plant Industry at the chestnut orchard maintained on the experimental farm at Bell Station, Glenn Dale, Md. Nest boxes, bird baths, and other bird-attracting devices have been installed to increase the number of birds, the aid of which is sought in the control of the weevils.

During the year a Farmers' Bulletin entitled "Homes for Birds" was issued, and this and a Farmers' Bulletin entitled "How to Attract Birds in Northeastern United States" were published also in revised form.

EXAMINATION OF STOMACHS

In the laboratory, examination was made of 871 stomachs of birds, 110 of mammals, 93 of toads, and 10 of alligators. In addition 2,296 pellets of hawks and owls were examined, nearly half of which were of marsh hawks collected for a study of their food habits in relation to quail in southern Georgia and northern Florida. Of the bird stomachs examined, those of quail, English sparrows, shorebirds, blackbirds, and fish eaters predominated.

Examinations also were made of stomachs of birds submitted by persons interested in the food habits of game or insectivorous species in Louisiana, South Carolina, Arkansas, Iowa, Illinois, Massachusetts, and Alberta. Nearly half of the mammal stomachs examined were of deer from the Kaibab National Forest, where large numbers have starved because they have increased beyond the capacity of their range to produce the food required to maintain them.

In the course of the year department bulletins were published entitled "Food Habits of the Vireos," and "Food of American Phalaropes, Avocets, and Stilts," based on laboratory analyses of stomachs. Manuscripts also have been prepared for Farmers' Bulletins on the starling in its relation to agriculture and on propagation of migratory and upland game birds.

FOOD HABITS OF REPTILES AND AMPHIBIANS

In addition to the completion of the examination of stomach material of toads and the compilation of the data obtained therefrom, work has been started on the examination of reptile-stomach material. A series of alligator stomachs obtained on muskrat marshes in Louisiana yielded interesting information on the food habits of these reptiles. Manuscript was submitted for a department bulletin on toads in relation to agriculture, horticulture, and forestry, and a mimeographed circular, "Facts about Snakes," was issued.

FOOD RESOURCES OF WILD FOWL

Surveys of the food supply for wild fowl in lakes and marshes were continued in the upper peninsula of Michigan and in Minnesota, and similar work was begun in the Upper Mississippi River Wild Life and Fish Refuge. In Louisiana, a study was made chiefly in the vicinity of the Rainey Wild Life Refuge of the effects of a prolonged drought upon aquatic vegetation attractive to wild fowl, with the resultant increase of the salinity of coastal waters. Additional surveys of wild-duck food resources were made on the delta of the Mississippi River in cooperation with the Louisiana Department of Conservation, and at points in Mississippi, Georgia, Florida, North Carolina, Arkansas, Texas, Maryland, and Virginia. Survey was made also of a number of military reservations in Louisiana about to be disposed of by the War Department to determine their utility as bird reservations, particularly for migratory waterfowl.

An inspection was made of Currituck Sound, N. C., to learn the cause of the failure of the food supply of wild fowl. A decided increase of the salinity of these waters had occurred, and investigation showed it to be due chiefly to the influx of salt water through the Chesapeake and Albemarle Canal. The removal of locks from this canal, when it was straightened, widened, and deepened a few

years ago, apparently has facilitated the flow of salt water into the sound, so that its waters, which for generations have been one of the most important wintering grounds for wild fowl, are becoming too salty for the growth of their food plants, and in proportion to the reduction in food supply are losing their great population of wild fowl, one of the most important economic resources of the region. The Biological Survey is cooperating with all individuals and organizations interested in checking the destruction by salinity of this most important feeding ground for migratory wild fowl.

A mimeographed leaflet on "The Care of Swans" was issued during the year and manuscripts were completed for publications on the relation of wild life to land values and on game birds suitable for naturalizing in the United States.

COOPERATIVE QUAIL INVESTIGATION

The beginning of the third year of the cooperative quail investigation in southern Georgia and northern Florida shows important progress in the study of the life history of the bobwhite quail and of factors governing its abundance and welfare. This has been made possible through the continued hearty cooperation and financial aid of interested sportsmen.

During the year a total of 100 quail nests were intensively studied and information obtained as to the cause of destruction of a large proportion of them. Approximately 80 per cent of the nesting attempts were found to be failures, although by repeated efforts many of the pairs finally succeed in raising broods.

As an aid to the study of the covey relationships and movements of quail, 833 native wild quail were trapped and banded as well as 1,000 other birds that were imported and liberated for restocking purposes by local sportsmen. Records of more than 200 returns from these birds indicate that the species have no extensive movements—fully 50 per cent having been shot or recaptured within a quarter of a mile of the point where banded.

As a basis for a study of food habits, 487 crops and gizzards of quail have been collected and examined. Studies have been continued of the various factors that influence the natural food supply, as cultivation and fires, and experimental plantings of desirable foods have been made to develop information helpful to those wishing to supplement the natural supply for these birds.

Propagation experiments are being conducted with a limited number of quail, and observations made upon their diseases as well as their behavior in captivity. Correlated with this has been the examination of many quail shot by sportsmen, with the object of determining the prevalence of both internal and external parasites.

Series of experiments were carried on during April to ascertain the most effective and economical means of controlling cotton rats on quail preserves, previous studies having shown that these rodents destroy quail eggs as well as compete with the quail for food. Interesting information was gathered as to the benefit at times derived from certain hawks that prey upon cotton rats. Eleven hundred pellets of marsh hawks, picked up on a heavily stocked quail preserve, proved on analysis to contain among other items the remains of 925 cotton rats and only 4 quail. Cotton rats are important destroyers of quail eggs, and results of examination of these pellets indicate that the marsh hawk may be a decided factor for the good of the quail.

A mimeographed report of progress was issued in the fall of 1925, covering such topics as mapping large quail preserves of the region, preparing specimens for studies of plumage and molt, and collecting and preserving material for a study of food items.

DIVISION OF BIOLOGICAL INVESTIGATIONS

The index files of information of this division, now numbering approximately 1,600,000 cards containing data on the distribution, migration, and life histories of North American birds and mammals, have received many additions. These are constantly used in answering requests for information concerning the 3,500 forms of birds and the 2,500 of mammals known to inhabit the continent north of Panama and serve as a basis for the administration of much of the work of other divisions of the bureau.

REVISIONS OF MAMMAL GENERA

A revision of the ground-squirrel genus *Citellus* is practically completed. This group is of great economic importance because of its colonial habits, the number of the species, and the fact that the members inhabit diverse types of country and consequently damage

a great variety of crops. Certain of the species are carriers of bubonic and pneumonic plagues and spotted fever. A thorough understanding of the distribution, habits, and life histories of the numerous forms is highly desirable, as this information has a direct practical usefulness not only with regard to their relations to crop growing but also to the public health.

Work on a revision of the long-tailed shrews (*Sorex* and related genera) has been completed and the manuscript is nearly ready for the printer. Progress was made also on a revision of the kangaroo rats of the genera *Dipodomys* and *Microdipodops*, a group of economic importance. A revision of the species of *Phenacomys*, a group of small rodents, was in press at the end of the year, and similar work on the related genus *Synaptomys* is nearly ready for publication.

BIOLOGICAL SURVEYS OF STATES

With the exception of work in Florida, no State surveys were made during the year. In April and May a somewhat detailed examination was made of a considerable extent of Florida coast not before worked, and important biological information obtained. Definite arrangements are in progress with State institutions for the publication of an annotated list of the birds of the State, and the preparation of this work is well under way. Other reports comprising annotated lists resulting from surveys of States, other than those already published, are as follows: In press—Mammals of North Dakota; ready for publication—Mammals of New Mexico, Mammals of Oregon, Birds of Texas, Birds of New Mexico, Birds of Washington; in preparation—Mammals of Washington, Birds of North Dakota.

NATURAL-HISTORY EXPLORATIONS IN ALASKA

The early part of the fiscal year witnessed the completion of the cooperative expedition of the Biological Survey and John C. Phillips to the western part of the Alaska Peninsula and to Unimak, the easternmost of the Aleutian Islands. More detailed knowledge of the fauna of the region was desirable, as it is in part within the Aleutian Islands Reservation and is the home of a variety of important species of mammals and a breeding place of both resident and migratory birds. The expedition obtained valuable information concerning the resident game and fur-bearing animals, as well as on the breeding birds.

In the spring of 1926, another expedition was sent to Alaska partly for the purpose of banding migratory wild fowl. The results of the expedition sent in 1924 to the Yukon Delta have emphasized the value of banding as a means of ascertaining the lines of flight and the wintering grounds of birds breeding in particular areas, knowledge that is significant in the formulation of protective measures.

BIRD MIGRATION

Reports on the migration of birds have been received from about 335 volunteer observers, well distributed over the United States and the southern part of Canada, and especially valuable from the fact that many of the observers have been making the reports over a long series of years. Partly based on these reports, a study of the distribution and migration of the swallows is in preparation and has seen substantial progress during the year. By means of special field studies, significant data on the seasonal movements and abundance of several groups of economically important birds, notably the migratory waterfowl and the shorebirds, have been obtained.

BIRD CENSUSES

Reports of enumerations of birds found breeding on certain measured areas, usually typical of occupied farmlands, were received from about 100 volunteer observers in many parts of the country. Many of these came from cooperators who have reported on the same areas during previous seasons, and thus are extremely valuable, as such reports will eventually make it possible to prepare an estimate of the total bird population of the country.

BIRD BANDING

The past fiscal year marks the sixth and most successful year in bird banding since the work was assumed by the Biological Survey. The number of active cooperators shows a slight increase over last year, being now 1,134, of whom 98 are working in Canada. The total number of birds banded during the year was 68,418, an increase over last year, bringing the total number banded since 1920 to more than 200,000. The number of returns received during the year was 3,351, and the number since 1920 more

than 11,000. Banding cooperators are organized into four regional associations, and their sustained interest in the work has been particularly noted at their annual meetings, two of which were attended by a representative of the Survey. A publication for the use of the cooperators, "Trapping Ducks for Banding," was issued during the year as Department Circular No. 362. A report is in preparation summarizing the returns recently compiled in certain groups of birds.

REQUIREMENTS OF BIG GAME

During July, 1925, a representative of the bureau was engaged in making field studies of the life habits of the mule deer of the Grand Canyon National Game Preserve in Arizona, where a serious condition has developed because the deer have increased beyond the available winter food resources. Further examination of the animals and their environment was made by another assistant of the bureau during the last week of April and the first week of May, to obtain data reflecting spring conditions.

HABITS OF INJURIOUS RODENTS

Field studies of the relation of rodents to agriculture, horticulture, and forestry, which have been under way for several years, have been continued. They include the maintenance and observation of a series of fenced areas inclosing various types of forage, in which different controlled conditions allow for recording the effect produced by the inclusion or exclusion of various rodents and of livestock. Other rodent studies concern the porcupines, jack rabbits, ground and tree squirrels, pocket gophers, and pocket mice. Investigations also have been made of a few instances in which beavers have become troublesome, and it has been possible to trap and remove the surplus animals to more desirable localities.

EXPERIMENTS WITH TROPICAL GAME BIRDS

Attempts have been made during the past two years to introduce and acclimatize certain tropical game birds, including tinamous, curassows, ocellated turkeys, and chachalacas on Sapeloe Island, Ga. The chachalacas are breeding freely in various parts of the island and the curassows are showing signs of a desire to breed. Experiments with other birds so far have been unsuccessful.

MIGRATORY WILD FOWL IN MEXICO

Many conservationists and others have been urging the negotiation of treaties with Latin American countries for the protection of species of birds that winter south of the United States, similar to the migratory-bird treaty with Great Britain, which covers the protection of birds that migrate between the United States and Canada. In order to gather information on which diplomatic representations might be based, a biologist was sent to Mexico in January where he spent more than two months studying conditions on the principal wintering grounds of migratory waterfowl. It was learned that migratory game birds, especially ducks, spend the colder months in great numbers in the principal lakes and marshes as far south as the valley of Mexico, and that they are in urgent need of better protection, as they are decreasing in that section because of the slaughter for market that has been carried on with little restriction for many years. Mexican diplomatic and game officials have shown a desire to cooperate with the United States in game protection, and the matter is to be given further consideration.

DIVISION OF ALASKA INVESTIGATIONS

GAME IN ALASKA

Through representation on the Alaska Game Commission, the Biological Survey is in close touch at all times with the work of the commission and has been able to assist it in many ways during the first year of its operations. The old game law was in force until August 9, 1925, but on August 10 the regulations under the new law became effective. With one exception all the employees of the Biological Survey who had been engaged in the enforcement of the Alaska game law were reappointed. The commission held its second annual meeting in Juneau from February 3 to 24, 1926, with all members present. Most of its recommendations for changes in the regulations were approved and promulgated by the Secretary on May 18, 1926. These were published on May 18 by the game commission in its circular No. 2 entitled "Laws and Regulations Relating to Game, Land Fur-bearing Animals, and Birds in Alaska."

The best evidence of the public approval of the new game and fur law in Alaska is the strong enforcement of its penalties by the local courts. Of

55 cases brought before the courts up to January 31, 1926, 43 defendants pleaded guilty, 10 were convicted of the charges against them, and only 2 were acquitted. The courts ordered the confiscation from aliens and sale of 21 rifles, 9 shotguns, and 3 pistols. The following sentences imposed by the courts are of such severity as to render game and fur law violations unpopular in parts of the Territory where wardens can be maintained:

Possession of poison for killing foxes drew a fine of $25; killing geese out of season, $25; possession of skins of fur bearers caught before the season opened, from $25 to $100; trapping without a license, $25; trapping beavers out of season, $25 fine and 60 days in jail in one case and 90 days in jail in another; killing and possessing a female deer, $50; killing mountain sheep in a game refuge on the Kenai Peninsula, a fine of $250 and 90 days in jail. One registered guide had his license revoked by the commission for permitting his party to kill game illegally.

Proceeds received from licenses and other sources during the year and totaling $18,764.31 were divided equally between the Federal Treasury and the Territorial school fund. Although the funds for field work have been very inadequate for the proper protection of the valuable wild-life resources of Alaska, excellent results have been accomplished under the existing limitations in the short period the new act has been in operation.

BOAT PATROL WORK

As enforcement of the law is primarily through a patrol over the wide expanses of the Territory where transportation facilities are poor or entirely wanting, one of the first problems confronting the commission was that of, in part at least, overcoming this difficulty. The cabin cruiser *Sea Otter* continues to patrol the waters of southeastern Alaska. In October the *Marten*, belonging to the Biological Survey but loaned to the commission for use on upper Cook Inlet, was wrecked when the engine was disabled during a storm, the anchor dragged, and the vessel drifted ashore. At some sacrifice of other activities, the commission has been able to equip and put into service the *Seal*, a seaworthy motor cruiser 68 feet in length. It will cruise in the water embracing the Alaska Peninsula and adjacent islands, the Aleutian Islands, and Bristol Bay, and in summer along the Bering Sea coast as far north as the mouth of the Kuskokwim River. The region is noted for the severity and uncertainty of its weather, and no vessel less able could attempt the work.

ALASKA FUR ANIMALS

The fur crop, always an important source of revenue to Alaska, provides the only income from vast areas. Unfortunately, the breeding stock has been considerably reduced by overtrapping, but with vigorous enforcement of the new law the production can be greatly increased. As game is the only fresh meat to be had in large portions of the Territory, and as big-game hunters and lovers of the outdoors are each year visiting Alaska in greater numbers, increased efforts will be needed to maintain the big game and build up its numbers to the limits of the ranges.

SHIPMENTS OF FUR

Reports for the calendar year 1925 made to the Alaska Game Commission show the total value of skins of land fur-bearing animals exported from the Territory to be about $2,500,000, an increase of approximately $500,000 over the preceding year. Shipments of muskrat skins alone more than doubled. The number and value of the principal pelts were as follows:

Number and value of the principal pelts of land fur animals shipped from Alaska from January 1 to December 31, 1925

Kind of fur	Number of skins	Value	Kind of fur	Number of skins	Value
White fox	16,658	$583,089	Marten	3,647	$72,940
Mink	59,504	416,528	Otter (land)	3,265	62,035
Muskrat	395,142	335,870	Silver fox	577	51,930
Red fox	19,489	331,313	Cross fox	2,248	44,960
Blue fox	5,493	273,710	Weasel (ermine)	13,418	10,734
Lynx	7,920	134,640	Black (glacier) bear	930	6,510
Beaver	3,949	78,980	Polar bear	190	5,700

IMPROVEMENT OF REINDEER HERDS

In furtherance of studies of the reindeer herds and observations of the range and of the abundance and distribution of forage plants, local agents of the bureau have visited the herds during round-ups and assisted native and white owners in solving problems for the improvement of herd management and finding a more ready market for surplus stock. A report, Department Bulletin No. 1423, "Progress of Reindeer Grazing Investigations in Alaska," was in press at the end of the year.

PROPOSED RANGE EXTENSIONS

An extended trip was made during the year to the upper Kantishna country to determine its suitability for the location of a reindeer herd and its possibilities as a stock driveway. It was found that the area was not suitable for holding a herd, but that it could be used in driving stock across from the Kuskokwim Valley to the Alaska Railroad, thus avoiding passing through the Mount McKinley National Park. The matter of urging owners of reindeer herds to move them to the ranges near the Alaska Railroad so as to have better marketing facilities for surplus stock is being taken up with the railroad officials, and a satisfactory cooperative understanding probably will be worked out.

ALEUTIAN ISLANDS

Practically all the islands in this reservation best adapted to the purpose, 76 in number, are now occupied for fur farming, principally with blue foxes. No further permits have been issued during the year. The sheep-grazing industry there is progressing with improved prospects, through agreements with the department whereby one company operates on the western end of Unalaska Island and another operates on Unalaska and Umnak Islands. Other islands in this reservation are being carefully investigated with a view to occupying them for sheep grazing.

REINDEER EXPERIMENT STATIONS

Arrangements are being made for establishing the main reindeer experimental station of the bureau at the Alaska Agricultural College near Fairbanks. It is planned to conduct the work at this station in cooperation with the agricultural college. This will help solve many problems affecting the reindeer industry, and young Alaskans can be trained for the reindeer business. At Broad Pass a substation may be established where herd control on interior ranges can be studied and other important problems solved. Officials of the Alaska Agricultural College and of the Alaska Railroad have expressed a desire to cooperate in every way possible in the establishing of these experiment stations.

TRANSPORTATION OF REINDEER FOR RESTOCKING

Officials of Canada have begun an investigation in connection with a project for stocking northern Canada with reindeer from Alaska and have sent two representatives to Alaska to get a practical knowledge of reindeer herd management and of reindeer forage plants under the guidance of Biological Survey experts. Another purpose of the Canadian representatives is to get information on the best breeding and grazing grounds over which to make a drive of approximately 2,000 reindeer to the Mackenzie River delta region. It has been estimated that such a drive would take about three years and would cost about $100 for each animal. This drive is planned to try to provide reindeer to enable the Eskimos of northern Canada to become self-supporting. The Biological Survey is giving all the cooperation possible in this undertaking.

DIVISION OF GAME AND BIRD RESERVATIONS

Federal reservations administered by the Biological Survey for the conservation of wild life now number 72, including two bird refuges added by Executive order during the year, and the Upper Mississippi River Wild Life and Fish Refuge, the acquisition of lands for which is now well under way.

BIG-GAME PRESERVES

Four of the big-game preserves are fenced areas. Three of them were originally established primarily to save the buffalo from threatened extermination, and all are now being developed as game farms for the buffalo, antelope, mountain sheep, and other big game that may be used for restocking purposes. The winter elk refuge is of vital importance, insuring as it does the saving from starvation during severe winters of large num-

bers of elk of the southern Yellowstone and adjacent regions.

The most noteworthy activity on the big-game preserves during the year was the disposal of a number of surplus animals, especially elk from the National Bison Range, Mont., and the Wind Cave National Game Preserve, S. Dak., where they had increased until they threatened serious injury to forage in the preserves. From the four fenced preserves, surplus game animals sold during the year netted the United States Treasury $24,246.65.

Big-game animals on reservations administered by the bureau, with the exception of the antelope, have increased notably during the last 10 years. The increase in mountain sheep from the 12 (4 rams and 8 ewes) introduced on the National Bison Range in 1922 to about 50 in 1926 shows in a gratifying way what can be expected of these splendid game animals when accorded proper protection. Antelope, which had increased from 47 in 1916 to 91 in 1921, unfortunately through losses in 1922 and 1923 were reduced to 16, mainly by sudden inroads of predatory animals during stormy weather, thus again affording a striking illustration of the necessity of controlling such game-and-stock destroyers. With the better control of the predatory animals that has been initiated antelope are again increasing, and with a part of the fawns captured in Nevada in 1924 for restocking purposes, now number 26. Of 12 young antelope captured in Nevada at the same time and transplanted in Grand Canyon National Park, Ariz., under the auspices of the Biological Survey, 3 have died but the addition of 3 fawns born in the spring of 1926 restored the original number. The total number of big-game animals now on reservations administered by the bureau is about 1,530.

NATIONAL BISON RANGE, MONT.

The numbers of big-game animals on this range at the close of June were approximately, as follows: Buffalo, 566 (including 116 calves); elk, 257; mule deer, 102; white-tailed deer, 35; mountain sheep, 50; and antelope, 3. During the year 66 buffalo were disposed of as meat and 7 were shipped alive to public parks.

The overcrowded condition that had developed on this range was materially relieved by the removal of 388 elk in February, before the grass began to grow. The sale of these animals to a grazing and breeding association in Massachusetts necessitated the construction of over 5 miles of fencing for their capture. The capture and removal of these elk was the greatest operation on record in this country of handling big game on a wholesale scale. Only a small number were lost during the operation.

WIND CAVE NATIONAL GAME PRESERVE, S. DAK.

Game animals on the Wind Cave National Game Preserve, S. Dak., are as follows: Buffalo, 143 (including 21 calves); elk, approximately 130; antelope, 15. The antelope are increasing. During the year 10 buffalo (5 bulls and 5 cows) and 62 elk were shipped alive to various points.

ELK REFUGE, WYO.

The year was favorable for hay production, and about 950 tons were harvested on the Elk Refuge, and this was supplemented by approximately 600 tons raised on adjacent lands purchased by the Izaak Walton League of America. The State of Wyoming also provided a considerable tonnage to be fed to elk on private lands in Jackson Valley. Twenty-two acres of oats were harvested, yielding 1,177 bushels of grain for use on the refuge.

The past winter in Jackson Hole Valley was one of the mildest recorded in many years. There was only about one week of severe weather, and light falls of snow in January and early in February were soon melted by warm south winds, after which the refuge was practically free from snow. Approximately 4,500 elk wintered on the refuge and on the neighboring ranches and foothills. With sufficient forage on the meadows and pasture lands to supply their needs it was not necessary to feed them at any time. Only six were found dead during the period they were on the refuge and in the vicinity.

Owing to the mild winters since that of 1921–22, and the comparatively few elk killed by hunters—less than 1,000 in 1925—the southern Yellowstone herds have been increasing so rapidly that there is now an unwieldy surplus. Counts have indicated that under such conditions the rate of increase in the herds is about 25 per cent a year. On this basis it is estimated that on June 30, 1926, these herds numbered probably 30,000 animals. Winter range and forage is the limiting factor for elk, and the bureau considers 20,000 the maximum number that under pres-

ent conditions can find sufficient food in this district to survive the severe winters that frequently recur.

It is estimated that only about 650 tons of hay will be harvested on the refuge this season, because of lack of rain since the middle of May, but with that furnished by the State of Wyoming and the Izaak Walton League and an accumulated supply, well over 4,000 tons will probably be available. This should carry 12,000 elk through a severe winter, but under the changing conditions an even greater number might visit the refuge. Additional winter range and forage, properly located, is desirable for the maintenance of even a reasonable number of elk, but it is obvious that sufficient winter feed can not be supplied for ever-increasing numbers. If the present rate of increase is unchecked, frightful suffering and mortality will be inevitable during the first severe winter. Some of the surplus elk might be used for restocking purposes, but the most practicable means of removal seems to be through better provision for regulated hunting.

SULLYS HILL NATIONAL GAME PRESERVE, N. DAK.

During the year 11,184 persons visited Sullys Hill National Game Preserve, N. Dak., its accessibility having been increased with the practical completion of a new road, known as the Devils Lake–Fort Totten Highway, which passes through about 2 miles of the preserve. Animals maintained here include 15 buffalo (including 3 calves), 41 elk (including possibly 10 calves, a definite count of which can not be obtained until later in the year), 2 antelope, and 1 deer. During the year 1 buffalo died, a cow 23 years old that was presented to the preserve by the city park authorities of Portland, Oreg., when the herd was established in 1918. Four elk were sold for meat and 12 were shipped for breeding or exhibition purposes. Game birds permanently on this interesting preserve include 9 Canada geese, 3 wood ducks, 3 golden pheasants, and 7 Chinese pheasants.

NIOBRARA RESERVATION, NEBR.

Big-game animals on Niobrara Reservation on June 30 were as follows: Buffalo, 71 (including 14 calves); elk, 92 (including about 20 calves); antelope, 6; white-tailed deer, 1. The buffalo and elk are in a thriving condition. Four of the antelope died late in 1925, but the six animals remaining appear to be doing well.

BIRD REFUGES

The bird refuges administered by the bureau afford feeding and resting grounds for migratory waterfowl and protected breeding places for many interesting game and nongame species that are being reduced in numbers or threatened with extermination. The Brevard Island Reservation, on the east coast of Florida, and the Johnston Island Reservation, in the Hawaiian Group, were established during the year. Brevard Island has become an important breeding place for brown pelicans, which have been driven from their old home on Pelican Island in Indian River. The Johnston Island Reservation, consisting of Johnston Island, about half a mile long and a quarter of a mile wide, and Sand Island, about half as large, is about 500 miles south of the chain forming the main Hawaiian Group and is the breeding ground for thousands of shearwaters and terns and hundreds of other sea birds.

UPPER MISSISSIPPI RIVER WILD LIFE AND FISH REFUGE

Under authority vested in the department by act of Congress and the passage of enabling acts by the legislatures of Minnesota, Wisconsin, Iowa, and Illinois, examination and purchase of lands for the Upper Mississippi River Wild Life and Fish Refuge was begun in the fall of 1925. An office has been established at Winona, Minn., with a superintendent in charge of a small technical force engaged in land valuation and purchase activities. At the close of the year, organization had been completed and much preliminary examination work accomplished. Lands have been acquired or were in process of acquisition to the extent of approximately 31,500 acres, including, in addition to purchases, islands already in the possession of the Government and areas donated for the refuge.

MIGRATORY-BIRD TREATY AND LACEY ACTS

In the administration of the migratory-bird treaty act, protecting birds migrating between the United States and Canada, and the Lacey Act, regulating interstate commerce in game and the importation of foreign birds and mammals, much has been accomplished, although the inadequate war-

den force is a serious detriment to the work. Continued cooperation on the part of State game officials, United States district courts, United States district attorneys, and others interested has resulted in increased enforcement of these laws. Arrests of offenders and subsequent court action have had a wholesome effect in many places in bringing about a proper attitude toward the law, and educational work also has increased appreciation of its purposes. Every effort has been made to urge that contemplated drainage projects be wisely considered, with a view to preventing needless destruction of the breeding, feeding, and resting places essential to the perpetuation of the species sought to be protected by the Federal laws. The results of drainage and the reduction of water areas after a series of dry years are having a marked effect on the wild fowl of the West.

THE ADVISORY BOARD

The Migratory-Bird-Treaty-Act Advisory Board held its annual meeting in Washington on December 10, 1925, and considered proposed changes in the migratory-bird regulations submitted to it by the Secretary of Agriculture. The changes subsequently adopted by the Secretary and approved by the President were as follows:

A later open season for waterfowl was fixed in the States of Illinois, Indiana, Kentucky, New Mexico, California, and the eastern portion of Washington, and on mourning doves in South Carolina. These changes should prove beneficial in permitting young birds of the year to mature more fully and in avoiding the spoilage that frequently occurred in the earlier and warmer season. A separate season was prescribed in Massachusetts for the counties of Nantucket and Dukes (the islands of Nantucket and Marthas Vineyard), which are at such distance from the mainland that local conditions make desirable an open season different from that for the rest of the State. The season on black-bellied and golden plovers was closed indefinitely, as the golden plover appears to be decreasing and the black-bellied species shows little if any increase. The bag limit on Wilson snipe, or jacksnipe, was reduced from 25 to 20 a day, on sora from 50 to 25 a day, and on gallinules and rails (except sora), to 25 in the aggregate of all kinds, but not more than 15 of any one species. The daily bag limit on coots was fixed at 25.

PERMITS TO KILL INJURIOUS BIRDS

Under authority of Article VII of the migratory-bird treaty and of regulation 10 thereunder, orders were issued effective in the States of California, Connecticut, Kansas, Michigan, and New York, permitting the killing of certain migratory birds when found to be injurious to valuable fish life. These were based on the results of extensive investigations conducted by the Biological Survey, which disclosed that birds of the species involved—great blue herons, bitterns, and mergansers—were destructive to trout and other game fish in some localities. These orders will prevent the depredations of these birds without detriment to the future of the species.

VIOLATIONS OF THE TREATY ACT

There were 415 cases of violation of the migratory-bird treaty act pending on July 1, 1925, and during the fiscal year 540 additional cases were transmitted for prosecution. Of the total of 955 cases, 583 were disposed of as follows: 409 by conviction, 79 by dismissal, 7 by jury verdicts of not guilty, 9 by the operation of the statute of limitations, 49 were nol-prossed, 5 abandoned, 2 quashed by the court, 1 by sustaining a demurrer, and 4 closed by death of the accused. Nine cases tried before juries resulted in convictions.

Sixty-two cases reported by Federal wardens were not forwarded for prosecution because of youthfulness of the accused, insufficient evidence, adequate fines having been imposed in State courts, or other valid reasons. Many cases were turned over to State authorities for prosecution where violations of the State game laws were involved, and the resulting fines aggregated $6,495.97. In Federal courts jail sentences were imposed in 13 cases, and the fines ranged from $1 to $500, and, including costs, which in many cases exceeded the fines, amounted to $10,219.65. The fines averaged $28.04, as against $22.12 in 1925.

Convictions in Federal courts were distributed as follows: Alabama, 10; Arkansas, 9; California, 5; Delaware, 6; Florida, 17; Georgia, 20; Illinois, 78; Indiana, 10; Iowa, 9; Kentucky, 2; Louisiana, 26; Maine, 8; Maryland, 14; Massachusetts, 1; Michigan, 3; Minnesota, 32; Mississippi, 6; Missouri, 15; Nebraska, 3; New Jersey, 2; New Mexico, 4; New York, 2; North Carolina, 11; North Dakota, 3; Ohio, 1; Oregon, 1; Pennsylvania, 3;

Rhode Island, 3; South Carolina, 4; South Dakota, 17; Tennessee, 18; Texas, 39; Virginia, 15; Washington, 8; and West Virginia, 4; total, 409.

Migratory waterfowl, aigrettes, and mounted birds unlawfully killed or possessed and having a potential market value of approximately $12,000 were seized during the year, more than double the value of similar seizures in the preceding year. Seized birds that could be utilized as food were donated to public hospitals or to public charitable institutions. The nature of the violations and the penalties imposed in each case will be noted from the following selected cases terminated during the year:

Two offenders in Illinois, for hunting ducks in the close season, were required to remain in jail 7 days each pending the payment of their fines; another for similar default, and charged with the same offense, spent 4 days in jail; and still another charged with selling ducks, 25 days; in Virginia one offender charged with trapping ducks was imprisoned 5 days. Fifteen cases were terminated by the imposition of jail sentences.

Hunting ducks after sunset in Delaware brought a fine of $300, and in New Jersey $500, as this was the violator's third offense and the maximum fine was imposed. In Virginia trapping ducks cost two offenders, respectively, $100 and $370. In Georgia two cases of shooting doves out of season resulted in fines of $150 each. In Missouri two cases of hunting ducks in the close season brought fines of $100 each and a similar case in Ohio $50. In West Virginia killing ducks from a motor boat cost a fine of $50, and in Michigan three cases of killing coots from a motor boat cost in each $50. In Arkansas it cost two offenders $15 each for hunting migratory wild fowl from an airplane. In Tennessee two fines of $25 were imposed for exceeding the bag limit. In Florida the possession of plumes of egrets and snowy herons cost $450, and in Illinois the possession of aigrettes cost $300. In Illinois the possession of wild ducks in storage during the close season carried a penalty of $150 and court costs. In California, Louisiana, and two cases in Texas the sale of wild ducks cost the offenders $100 each, and in Mississippi the offer to sell a wood duck cost $50.

From the foregoing instances it is evident that many Federal judges are in sympathy with the law and do what they can to help enforce it.

DUCK SICKNESS

During the fall of 1925 an extensive mortality occurred among the wild ducks and some other migratory wild fowl at Malheur Lake in Oregon, and at Tule Lake and on the Sacramento Valley marshes in California. The number of dead ducks at one time in Tule Lake was estimated at about 50,000. The United States game warden with the cooperation of experts of the Bureau of Animal Industry and of the University of California tried to determine the cause, but without success. The sickness of the ducks was similar to that caused by alkali poisoning, but the surroundings strongly indicated the presence of some disease other than that. Investigations will continue to determine the cause of this menace to wild fowl.

INTERSTATE COMMERCE IN GAME

Six cases involving violations of the Lacey Act were reported for prosecution, and four of them were disposed of in Federal court during the year, the penalties aggregating $50. Cooperation with State authorities in the enforcement of State laws with reference to fur animals was more extensive than heretofore, and 2,448 cases, as compared with 1,000 for the previous year, were referred to State authorities as a result of activities of Federal wardens working alone or with State game wardens. In 330 of these cases disposed of in State courts, fines and costs aggregating $14,850 were assessed and 240 contraband beaver skins were seized by the States on information supplied through the Federal warden service. Jail sentences of 60 days each were imposed on two offenders, a third was committed in default of a $475 fine, and another, a minor sentenced to the industrial school, was placed on parole. During the year, 66 Federal investigations were closed mainly for the reason that the shipments were not made illegally. At the close of the year 253 cases were pending.

Special investigations in cooperation with State authorities have again been conducted in three raw-fur-buying centers, New York, Chicago, and St. Louis. The large volume of illegal traffic in furs and the many subterfuges resorted to by violators emphasize the necessity for an increased warden force and for additional Federal legislation to supplement that of the States, if adequate control of illegal interstate traffic in furs is to be maintained.

COLLECTING AND OTHER PERMITS

Permits issued during the year to collect migratory birds and their nests and eggs for scientific purposes numbered 197, which, with 1,221 valid until revoked and 1 revoked, made a total of 1,417 permits outstanding. Scientific-possession permits, issued mainly to taxidermists, numbered 287. For the possession and sale of waterfowl for propagating purposes 3,298 permits were in force, and 105 permits were issued authorizing 87 persons to capture waterfowl for propagation.

IMPORTATION OF FOREIGN BIRDS AND MAMMALS

Permits issued for the importation of foreign birds and mammals numbered 1,033, an increase of 52 over last year, and the shipments inspected increased from 239 to 295. Eight additional permits were issued for the entry of 109 miscellaneous birds at Honolulu, Hawaii. The total number of birds imported was 471,667, of which 11,683 were entered without permits.

MAMMALS

Permits for the importation of mammals included 7,809 foxes from Canada, a decrease from 1925. Following are the figures for the past five years: 8,424 in 1925, 4,871 in 1924, 2,753 in 1923, 2,064 in 1922, and 1,574 in 1921. An unusual number of black bears were imported from Canada during May and June for exhibition purposes, permits for 97 having been issued for shipments originating in four Provinces and consigned to widely scattered points in 10 States.

One case of entry of a prohibited species was reported during the year, a mongoose presented by a sailor to the Zoological Society of San Diego, Calif., and killed by order of the State authorities. A single mongoose that had been exhibited in the National Zoological Park, at Washington, died a few months ago, and at present, so far as known, there is only one mongoose on exhibition in the United States, a male, in the New York Zoological Park.

GAME BIRDS

Importations of game birds included 37,134 Mexican quail, 11,839 Hungarian partridges, and a few tinamous and waterfowl. During the year more interest was manifested in the importation of partridges, and a larger number was brought in than in any year since the war. Several shipments were from ports in Germany, but some seem to have originated in Czechoslovakia, which for several years has been the main source of supply. In 1924 the authorities in that country placed an embargo on shipments and for a time no partridges were received in the United States, but the entries have now increased to nearly a third of the maximum prior to the war.

Importations of Hungarian partridges this year were almost equally divided between the East and the West, and most of them were received by eight States, as follows: New York, 870; New Jersey, 425; Pennsylvania, 2,079; Illinois, 254; Minnesota, 1,079; North Dakota, 414; South Dakota, 864; and Colorado, 648.

EGGS OF GAME BIRDS

During the year 13 permits were issued for the importation of eggs of game birds from foreign countries, 6 less than in the previous year. These eggs were chiefly of pheasants from England and ducks and grouse from Alberta. The largest shipments comprised 1,000 ring-necked pheasant eggs from England, which arrived at New York on May 5; 108 duck eggs from Leduc, Alberta, which were authorized to enter at Portal, N. Dak., on May 15; and 160 duck eggs from Leduc, Alberta, at Eastport, Idaho, on June 5.

CAGE BIRDS

Cage birds, as usual, formed the principal part of the importations and consisted chiefly of canaries and parrots. The canaries numbered 330,000 and the parrots 53,770. Among the rare species imported were an imperial parrot (*Amazona imperialis*) from Dominica, a cicero (*A. versicolor*) from St. Lucia, and the rare parrot *Dasyptilus pesqueti* from New Guinea, by the New York Zoological Society. The imperial parrot has been imported three times before, but the other two have not previously been seen alive in the United States. Several rare birds from the South Pacific arrived at San Francisco, including a black cockatoo (*Microglossus aterrimus*) and four pigeons (*Gallicolumba helviventris*) from Australia, and two pigeons (*G. stairi*) from the Fiji Islands. Other notable species were 36 tinamous (*Nothoprocta perdicaria*) from Uruguay; 2 hyacinthine macaws (*Anodorhynchus hyacinthinus*), 1 pearly parrakeet (*Pyrrhura perlata*), 1 hawk

parrot (*Deroptyus accipitrinus fuscifrons*), and 1 crested guan (*Penelope jacuacu*) from Brazil; 6 argus pheasants (*Argusianus argus*), 4 greater birds of paradise (*Paradisea apoda*), and 2 king birds of paradise (*Cicinnurus regius*) from Singapore; and 2 copper pheasants (*Phasianus soemmerringii*) and 70 finches (*Stictospiza formosa*) from Japan.

IMPORTATION OF QUAIL FROM MEXICO

The season of 1926 proved the third largest for the entry of quail from northeastern Mexico since importations began in 1910. The total number imported was 37,134, of which 10,000 were entered at Eagle Pass, Tex., between February 17 and 26; 1,737 at Laredo between March 10 and April 24; and 25,397 at Brownsville between February 15 and April 24. As was the case last year, shipments were regulated through concessions granted by Mexican authorities, the entry of 10,000 being authorized at Eagle Pass, 10,000 at Laredo, and 50,000 at Brownsville.

Inspectors of the Bureau of Animal Industry examined all shipments at the border, but found no quail disease. Weekly reports were made on the condition of the birds and the details of the shipments, thus furnishing a complete check on the destination of entries. Nearly all were shipped to points south of Pennsylvania and the Ohio River, as follows: Texas, 5,721; Oklahoma, 10,000; Kansas, 4,969; Missouri, 515; Mississippi, 4,980; Alabama, 4,162; Georgia, 922; Kentucky, 3,399; Maryland, 700. Of the Northern States, Illinois received 662, New York 250, and other States 224. An interesting fact in connection with these importations is that three of the principal States—Kansas, Oklahoma, and Texas—that received Mexican quail furnished most of the stock for other regions 20 years ago, and in Oklahoma 1,000 quail were reintroduced at a point from which some of the largest shipments were formerly made.

The number of quail imported from Mexico since shipments began in 1910 now aggregates about 266,000, nearly all of which were bobwhites. A few requests were received this season for entries of quail from other parts of Mexico, but because of the requirement that export permits must be obtained from the Mexican authorities before shipments are made, comparatively few birds crossed the border.

At the request of some of the game commissioners and other persons interested, the Tariff Commission during the summer of 1925 made an investigation of the cost of capture and shipment of Mexican quail, and as a result the import duty on bobwhites was reduced in October from 50 cents to 25 cents each. The experience of the past season indicates that this reduction had little, if any, appreciable effect in increasing the importations, since the number entered was less than in 1925, when 39,170 birds were entered subject to a duty of 50 cents each.

EXHIBITION OF BIOLOGICAL SURVEY'S WORK

Concerned as it is with all phases of the conservation, utilization, and control of wild life, the work of the Biological Survey is being well portrayed topically under these three headings in an exhibit at the Sesquicentennial Exposition at Philadelphia. Conservation of game birds, fur animals, and other interesting, useful, or harmless forms of wild life, in relation to wisely utilizing the natural increase and preventing an undue abundance of forms that are injurious to man, are there depicted. The attention of great numbers of visitors at this exposition is thus drawn to the importance of the wild-life resources of the country from a dual viewpoint: On the one hand, as assets to be enjoyed in natural surroundings or as potential food or clothing; and on the other hand, as liabilities to be eliminated when they are in conflict with man's economy, particularly as they interfere with his production of livestock and of fruit, vegetable, grain, and other crops, or as they destroy the game and fur animals that are useful to him or that he considers more deserving of perpetuation.

Exhibits of like tenor, prepared in cooperation with the Office of Exhibits and the Office of Illustrations have been displayed in various parts of the country, at State fairs, at meetings of sportsmen's and stockmen's associations, and at the annual convention of the National Federation of Women's Clubs, at Atlantic City, N. J., and exhibit material has been used extensively by field representatives of the bureau in stimulating public interest in organizing campaigns for the control of wild-animal pests.

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